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United States Patent Application for:

STACKABLE RISER CONFIGURATION

Inventor: Norman W. Gavin

Prepared by: Jenner & Block, LLC
One IBM Plaza
Chicago, IL 60611
312.222.9350

STACKABLE RISER CONFIGURATION

Cross Reference to Related Applications

This application is a continuation of U.S. Patent Application No. 09/946,293, filed September 4, 2001, which is a continuation-in-part of Application No. 09/766,795, filed January 22, 2001, now U.S. Patent No. 6,484,451.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention pertains to stackable riser sections and riser covers for access risers. More particularly, the present invention pertains to connecting a series of riser sections in a way that provides improved vertical support that minimizes the effect of frost heaving and other forces due to vertical ground movement, and resists rotational forces resulting from lateral ground movement and to a removable riser cover for stackable riser sections. It further relates to the configuration of a riser cover that provides a fluid and gas tight seal to a riser section, and to structure to facilitate its removal from a riser section as well as facilitating locating the cover under ground and to the stacking of a plurality of riser covers for compact and stable shipment or storage. It also relates to a system and method of maintaining the position and shape of a riser section while the riser section is being anchored in concrete by using the riser cover for positioning and support during the anchoring process.

2. Discussion

Meters, splices, junction boxes, and other components of buried utility systems are often located inside hand-holes or manholes to enable easy access by utility workers from above ground. Often, utility systems provide such access facilities at key points, such as a major bend in an underground cable/conduit run or location of water or gas

meters and other equipment requiring servicing or inspection. Such access facilities have been constructed using pre-formed or poured concrete side retaining walls. Concrete can be expensive, particularly where the application requires a non-standard size or length, in which case setting forms and pouring concrete adds time and expense. Also, over time, the concrete can crack due to forces caused, for example, by freezing and thawing or by heavy vehicles being driven over the top of the manhole. Tiled sidewalls and concrete block are examples of other labor intensive alternatives.

Injection molded, plastic, stackable riser sections made of high density polyethylene and other rigid, light weight polymeric material are known in the art and provide a less expensive, standardized alternative that lends itself to rapid on-site customization. Riser sections can be manufactured in various heights and diameters, and a series of identically sized riser sections can be stacked to achieve a desired depth.

Depending on the soil characteristics and overhead traffic, the vertical, horizontal, and rotational forces placed upon these riser sections can be considerable. A major shortcoming of plastic riser sections lies in their tendency to deform or break when subjected to such forces. The use of vertical and horizontal strengthening ribs to alleviate this tendency is common. When placed along the exterior of the sidewall, however, these reinforcing ribs themselves often are subjected to the same vertical and horizontal forces they are intended to protect against.

United States Patent No. 5,852,901 for a "Stackable Riser for On-Site Waste and Drainage Systems," issued to Meyers, illustrates one prior art design of a plastic riser section for forming a depth-adjustable, grade-level access for underground components. The Meyers riser sections form a rigid structure intended to support heavy loads applied to the

grade level access lid. Identical riser sections reinforced along portions of both the inner and outer walls are stacked one on top of the other utilizing a single tongue and groove connection. A horizontal rib extending outward along the circumference of the external surface of the side wall of each cylindrical riser section and a plurality of vertical ribs, also on the external surface of the riser, individually anchor each riser section in the ground. A plurality of riser sections can be stacked to form a vertical, air-tight, liquid-tight, and gas-tight riser stack and cover system.

The shifting of the ground surrounding the riser stack disclosed in the Meyers patent can twist and move the stacked riser sections, knocking them out of alignment. Eventually, the shifting can lead to rupture of the stacked riser sections' sidewall. The presence of external horizontal and vertical reinforcing ribs extending along the wall of each riser, while strengthening the riser section sidewalls, also exacerbates this problem because shifting soil applies force against each exposed rib. The configuration of the tongue and groove arrangement of the riser sections disclosed in the Meyers patent also precludes the placement of supporting ribs along the full vertical length of the interior riser section wall, which lessens the sidewall's resistance to forces exerted by the shifting of the soil abutting the sidewalls and external ribs.

It is also common for one section of a riser stack to be anchored in concrete. The anchored section, generally the section defining the opening into the chamber defined by the concrete walls of an underground component, is then used as a base for the riser. Other sections are stacked on top of the anchored section to the desired height of the riser. This process involves positioning and securing a hollow riser section inside a concrete mold or form of a shape for forming the top wall of a chamber or underground component. The

concrete is then poured into the mold around the riser section. The riser section can be subjected to stress during this process and may deform or break under these conditions. In addition, because it can be made of light weight plastic, it can be difficult to keep the riser section in place while pouring the concrete because the riser section may tend to float in the concrete.

One method of preventing deformities in the riser section during anchoring involves the addition of cross braces to the inside of the riser. The braces can conform to the shape of the riser section or can simply be metal or wood rods sufficiently long to provide lateral support for opposed riser section sidewalls. This solution is imperfect, however, because the sidewall support thus provided is not uniform and may still permit deformities to occur. Additionally, this solution adds to the cost and time needed to anchor a riser section in concrete.

A variety of methods have been employed to keep a riser section in place during the anchoring process, with almost all involving construction on an ad-hoc basis in the field. One method is to place one or more elastic straps or rubber cords across the top of the concrete form, ensuring contact with the riser section in order to hold it down. This does not address side-to-side movement. One way to attempt to control this is by placing a weight or heavy object, such as a concrete block, on top of the riser section and under the elastic strap. The weight, however, may create an additional problem because it adds to the stresses being applied to the riser section sidewalls during placement of the concrete.

Another difficulty with the use of plastic riser sections is locating the riser stack after installation. Many riser access facilities are located in areas where it is easy to locate the opening, such as in streets, sidewalks, and other paved areas, or where the opening

is above grade. However, access facilities frequently are located below grade level and are covered by soil and grass or other vegetation. In these situations, it may be difficult to locate the opening of the access facility when required. While a metal cover may be located using a metal detector, plastic stackable riser sections may not. One method of making plastic riser stacks locatable is to mold one or more metal rods into the concrete wall into which a plastic riser section has been anchored. Because the concrete wall is typically lower in the ground than the riser cover, a significant amount of metal is required in order to ensure it can be detected at the surface using a conventional metal detector. This method may also create an added step in casting the wall of the box into which the bottom riser section is anchored.

SUMMARY OF THE INVENTION

The riser sections and cover of the present invention overcome the foregoing shortcomings. In the preferred embodiment, the stackable riser sections of the present invention have a hollow, cylindrical configuration, although configurations other than cylindrical may be used. The sidewall of the riser section includes a channel end and a tapered end. In the preferred embodiment, the riser section has a nearly smooth exterior surface from which projects outwardly a detachable anchor tab that may run along substantially the full circumference of the riser. The channel end of the riser section sidewall includes two adjoining channels which are defined by interior, middle, and exterior walls that extend down from a horizontal ledge on the interior surface of the side wall at the channel end. The walls project concentrically with, or (in the case of riser sections having, for example, a square or rectangular cross-section) parallel to, the sidewall. The opposite, or tapered, end of the riser section sidewall terminates in a portion tapered to a narrower thickness at the end. A plurality of vertical reinforcing ribs are spaced around the interior

surface of the cylindrical sidewall of the riser. Because in the preferred embodiment the ribs extend from the horizontal ledge at or near the channel end to the distal end of the tapered end of the riser section sidewall, they strengthen the sidewall in the area of the joint between each pair of stacked riser sections.

In the preferred embodiment, the interior surface of the sidewall also includes at least one, and preferably more than one, boss extending vertically from the horizontal ledge near the channel end to the distal end of the tapered end of the riser. Each boss is adapted to receive a screw, or other fastener, that extends through he horizontal ledge of a riser section stacked above the tapered end for securing that riser section stacked on top of the first riser section. The bosses also may receive a screw to attach a cover at the top of a riser stack.

The tapered end of the riser section sidewall is configured to mate with the two concentric channels of either another riser section or a cover. The radially outer channel is shallower than the inner channel in the preferred embodiment and accepts the tapered end of the sidewall of another riser section on which it is placed. An O-ring placed in the outer channel can be used to effect a water-tight and gas-tight seal between two stacked riser sections (or between a riser section and a cover).

The radially inner channel is wider than the outer channel, and accepts the interior vertical support ribs and bosses of a riser section on which it rests. The middle wall of the channel end includes slots that permit positioning of the bosses and ribs within the inner channel of a riser section positioned above the ribs and bosses. Projections on the bottom of the horizontal ledge and aligned with the slots support the upper riser section on the bosses as ribs of the lower riser section.

In the preferred embodiment, a detachable anchor tab on the exterior surface of the riser section sidewall serves to anchor the lower-most riser section in concrete, for example, in the wall of a concrete distribution box. The concrete is poured around the riser section and its anchor tab, thereby anchoring the bottom riser section after the concrete hardens. Another identical riser section may be placed on top of the bottom riser section, with the tapered end of the bottom riser section mating with the channel end of the riser section placed on top of the bottom riser section. The anchor tab on each of the riser sections stacked above the bottom riser section (i.e., above the riser section anchored in the concrete box) in a given stack can be detached by tearing it away from the exterior of the sidewall. In the preferred embodiment, the anchor tab includes a handle for this purpose. Tearing away the anchor tabs on the riser sections that are not anchored in concrete gives the riser stack a nearly smooth exterior surface, thereby minimizing the forces exerted on the riser stack by movement of the soil in contact with the riser stack.

There also is provided, in the preferred embodiment, a cover adapted to be secured to the top of a riser section. Like the stackable riser, the preferred shape is cylindrical, but other configurations, such as square, rectangular or elliptical may be used.

The cover has a top surface and a bottom surface, with the top surface being nearly smooth and slightly convex in the preferred embodiment. A sidewall of the cover depends from the top surface. It includes a channel end similar to the channel end of the riser sections. The channel end includes two adjacent concentric channels defined by inner middle and outer walls. The outer wall defines the sidewall outer surface of the cover.

Handles to aid in removal of the cover are provided on the top surface of the cover. In the preferred embodiment, each handle pivots about a support shaft which is

attached to the cover by a screw or other fastener. The support shaft is set inside a recess adjacent the top surface, and the handle pivots between a position generally perpendicular to the top surface and a position inside the recess, substantially parallel to and flush with the top surface. The recess is large enough to accept the entire handle.

The cover preferably has at least two wells open to the top surface. They may be substantially 180° apart in the preferred embodiment, although another embodiment may have only one well or more than two wells. The wells are defined by hollow posts depending from the bottom surface of the cover.

In a preferred embodiment, the hollow posts on the bottom surface extend below the bottom edge of the channel end of the cover. The posts define the wells open at the top surface, as described above. Preferably, the posts are located approximately midway between the center of the bottom surface and the cover channel, about 180° apart from each other. In different embodiments, there may be only one post or more than two posts, in which case the posts may be located as desired on the bottom surface.

The posts extending from the bottom surface of the riser cover preferably are tapered such that each is of a larger diameter where it joins the bottom surface of the cover than at its free end. There may also be a stepped change in diameter at some point between the bottom surface and the end of the post, creating a shoulder. The diameter of the free end of each post is smaller than the diameter of the hollow well formed by the post. The tapered design of each post and well allows stacking of multiple riser covers by placing the posts of one riser cover into corresponding wells in the top of another riser cover. Stacking of riser covers is beneficial for storage and for shipping multiple riser covers.

The wells open to the top of the riser cover may receive a metal bar prior to completion of the underground component such as a concrete distribution box installation in the field. As described above, it is common for riser covers to be buried by soil and vegetation growth. The placement of the metal bar into the well allows the cover and plastic riser sections to be located using a metal detector.

The riser cover can be used in a method to secure a riser section while the riser section is being molded in concrete (i.e., while the wet, viscous concrete is poured and is setting). In the preferred method of securing a riser section in concrete, a mounting bracket is provided which is adapted to receive the posts depending from the bottom surface of a cover. The mounting bracket adapted to be secured to the wall of a concrete form preferably has two (or other number corresponding to the number of posts in the cover) holes configured to accept and releasably retain the posts of the riser cover. The holes are sized and tapered such that when the posts are pushed into the holes, the sides of the holes grip the posts in a fraction fit and thereby firmly secure the cover to the bracket.

During the concrete casting operation, the mounting bracket is secured to a horizontal wall of a concrete form at a desired location where the access riser is to be provided. The riser section is positioned on the form surrounding the bracket. A riser cover, positioned with the channel end of the cover engaged with the tapered end of the riser section is attached to the bracket. The posts of the cover are aligned with, and pushed into, the holes on the mounting bracket such that the posts are gripped securely by the bracket. The riser section is thus positioned and secured properly relative to the bracket and, particularly, the concrete form. The riser section is also supported against deformation during a pour. Concrete sufficient to secure the riser section is then poured into the form and allowed to

cure. The riser cover, which has not been in contact with the concrete, is then removed from the riser section by pulling the posts out of the holes in the mounting bracket. The mounting bracket may then be removed and the form disassembled from the poured concrete wall.

It is an object of the present invention to provide an improved connection configuration that resists rotational forces exerted on one or more riser sections in an interconnected system.

It is another object of the present invention to provide improved reinforcement of the sidewalls of riser sections stacked one on top of the other.

It is still another object of the present invention to provide a detachable anchor on the exterior surface of a riser section, the anchor being used when the riser section is to be molded in concrete, and removed when the riser section is to be in contact with soil.

It is a further object of the present invention to provide a riser section adapted for being anchored in concrete, while at the same time minimizing the susceptibility of a riser stack to forces caused by the ground next to the stack shifting.

It is a further object of the present invention to provide a riser cover having recessed handles such that the riser cover will have an essentially smooth top exterior surface when the handles are not in use.

It is still a further object of the present invention to provide a method for positioning and supporting a riser section being molded in concrete to minimize the susceptibility of movement of the riser section during the molding process and resist deformation of the riser section due to the forces exerted by the concrete while being poured.

It is still a further object of the present invention to provide a riser cover adapted for being stacked one on top of another with the posts of the top cover projecting

into the wells of the bottom cover such that multiple covers may be stacked compactly and stably for shipping or storage.

It is another object of the present invention to provide a plastic riser cover adapted to easily receive a metal bar in order to permit the cover to be located after it has been buried in soil or other material.

Other features, objects and advantages of the invention will become apparent from the following description and drawings in which the details of the invention are fully and completely disclosed as part of this specification.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of the present invention are explained in more detail with reference to the illustrative embodiments shown in the following drawings.

FIG. 1 is a top view of a cylindrical riser section embodying the principles of the present invention;

FIG. 1A is a fragmentary sectional view on an enlarged scale, taken along the line A-A of FIG. 1;

FIG. 2 is a cross-sectional view of the riser section embodying the principles of the present invention taken along line 2-2 in FIG. 1;

FIG. 2A is a fragmentary cross-sectional view of a riser cover for overlying a riser section embodying the principles of the present invention;

FIG. 2B is a fragmentary cross-sectional view of a pair of riser sections assembled together.

FIG. 3 is a side view of a cylindrical riser section embodying the principles of the present invention;

FIG. 3A is a fragmentary sectional view on an enlarged scale of a portion of the riser section of FIG. 3;

FIG. 4 is perspective view of a cylindrical riser section embodying the principles of the present invention;

FIG. 5 is a perspective view of the top surface of a riser cover embodying the principles of the present invention;

FIG. 6 is a perspective view of the bottom surface of a riser cover embodying the principles of the present invention;

FIG. 7 is a cross-sectional view of the riser cover embodying the principles of the present invention taken along line 7-7 of FIG. 5;

FIG. 8 is a detailed view of a handle adapted to fit the riser cover embodying the principles of the present invention;

FIG. 9 is a top view of a mounting bracket for use in the method of the present invention employing a riser cover to embed a riser section in concrete;

FIG. 10 is a perspective view of the mounting bracket of FIG. 9;

FIG. 11 is a is a cross-sectional view of the riser cover embodying the principles of the present invention mounted onto the mounting bracket employed in the method of the present invention taken along a line 7-7 of FIG. 5 for the cover and a line 11-11 of FIG. 10 for the mounting bracket;

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Terms such as upper and lower, top and bottom, above and below, as used to describe the illustrated embodiments have their ordinary and usual meanings and are applied to riser sections and covers as they would normally be oriented in association with an

underground component such as a concrete distribution box. The riser sections and covers illustrated are generally concentric about an imaginary vertical centerline. Terms such as inner, internal or interior, mean toward the centerline, and outer, external or exterior mean away from the centerline.

Referring to FIGS. 1 - 4, in the preferred embodiment of the present invention a riser section **10** includes generally cylindrical sidewall **12** having a plurality of vertical bosses **24** and a plurality of vertical reinforcing ribs **26** on the interior surface of sidewall **12**. The exterior surface of sidewall **12** is devoid of vertical reinforcement elements.

Attached to the substantially smooth exterior surface of sidewall **12** is detachable anchor tab **14** (discussed below). Sidewall **12** has a top, tapered end **37**, and a bottom, channel end **27**. (In an alternative embodiment, end **37** could be straight rather than tapered.) Alternatively, the tapered ends **37** could be on the bottom and the channel ends could be on the top in a stack of riser sections **10** of the present invention.

In the preferred embodiment, tapered end **37** includes on the external surface of sidewall **12** a horizontal edge surface **38** (i.e., edge surface **38** is substantially perpendicular to the axis of the vertical riser section and the external face of sidewall **12**). With reference to FIG. 4, edge surface **38** extends around the circumference of sidewall **12**. End **37** includes a tapered portion **30** extending from horizontal edge surface **38** to the distal end of tapered end **37** of sidewall **12** of riser section **10**. Tapered end **37** thereby forms a unique male connector. The opposite end of riser section **10** forms a corresponding female connector, referred to herein as channel end **27**, as described below.

Referring to FIGS. 2, 3 and 4, the channel end **27** of riser section **10** comprises a unique dual channel arrangement in which outer wall **18**, middle wall **20**, and inner wall **22**

extend relative to an internal horizontal ledge **28**, and generally parallel to the exterior surface of sidewall **12** to define outer channel **19** and inner channel **23**.

Horizontal ledge **28** on the interior surface of sidewall **12** (see FIGS. 1, 2, 3A and 4) is generally perpendicular to sidewall **12**. As shown in FIGS. 2 and 4, bosses **24** and ribs **26** extend vertically from ledge **28** to the distal end **40** of tapered end **37**. Bosses **24** are attached to or formed on the interior surface of sidewall **12** by an offsetting portion **24a** (see FIG. 4) that extends from the inside surface of sidewall **12** to the boss **24**, connecting member or offsetting portions **24a,** which preferably runs along the full vertical height of each boss **26**. End **37** of riser section **10** includes the ends **40b** and **40r** of vertical bosses **24** and ribs **26**, respectively, the ends **40b**, **40r** being flush with the horizontal edge **40** on the end of tapered portion **30** of sidewall **12**. The top surfaces **40b** of offsetting portions **24a** and bosses **24** and top surfaces **40r** of ribs **26** are flush with the top surface **40** of tapered end **37**.

Referring to FIG 2B, when the tapered end **37** of one riser section **10** and channel end **27** of another riser section **10** are mated, top edge **40** of tapered portion **30** is positioned within outer channel **19**, which is the channel or space between inner surface **32** of outer wall **18** and outer surface **46** of middle wall **20**. Bottom edge **36** of outer wall **18** thus rests upon edge **38** on the exterior surface of sidewall **12**.

As seen in FIG. 2B, when one riser section is placed on top of another, top edge **40** of the riser section on the bottom projects into outer channel **19** of the upper riser section. In the preferred embodiment, an O-ring **45** or similar resilient gasket is positioned at the bottom **19a** of outer channel **19** such that when the first riser section is placed on top of a second riser section top edge **40** of tapered end **37** abuts against the O-ring **45** to provide a substantially water-tight and gas-tight seal.

Sealant can be applied to the area where the tapered end **37** of a first riser section **10** contacts the outer channel 23 of another riser section **12** (or a cover **50**) stacked on top of the first riser section **10** to further ensure a water-tight, gas-tight seal between adjacent riser sections **10** (or between a riser section **10** and a cover **50**) beyond that provided by the dual channel design of the present invention.

As shown in FIGS. 2 - 4, and in particular FIG. 3A, channel end **27** of the present invention includes middle wall **20** having slots **16** at regular intervals. The slots **16** are spaced in middle wall **20** of a first riser section **10** such that they align with offsetting portions **24a** of bosses **24** and with ribs **26** of an end **37** of a second riser section **10** when the first riser section is placed on top of the second riser section. Bosses **24** and ribs **26** of the second riser section **10** thereby extend into inner channel **23** of the first riser section **10.**

With reference to FIGS. 2, 3 and 3A, each slot **16** extends from end **20a** of wall **20** to top **16a**. The top **16a** of each slot **16** is flush with the end **42a** of a vertical projection **42** in inner channel 23. Each projection **42** (shown partially by the phantom lines in FIG. 3 and shown in FIG. 3A) projects into outer channel **23** a height indicated by line **48** (see FIG. 2). Offsetting portions **24a** of bosses **24** and supporting ribs **26** of a first riser section are adapted to slide into slots **16** in a second riser section when the second riser section is placed on top of the first rise section. In a preferred embodiment, slots **16** and corresponding projections **42** are spaced midway between bosses **24** and ribs **26** which increase the structural integrity of the riser section **10.**

The vertical bosses **24** each contain on their end **40b** a hollow bore adapted to accept a screw, or other suitable fastener. Projections **42b** are provided in riser section **10** that align with a boss **24** of another riser section **10** when stacked. Projections **42b** are

somewhat wider than projections **42** not aligned with a boss 24. Such bosses contain a hollow bore best shown in FIGS. 1 and 3A so that a screw or other suitable fastener (not shown) can be inserted through projection **42b** in the first riser section **10** into the top end of a boss **24** below it in a second riser section **10** to fasten the two riser sections together. In that case, ledge **28** contains an opening **52** over the projections **42b** having the hollow bores so that a screw or other fastener may be inserted through projection **42b** and into the top end **40b** of boss **24** below it when two riser sections **10** are stacked.

As shown in FIGS 2B, 3A and 4, when two riser sections **10** are placed one on top of the other, slot **16** can accept either, referring now to FIG. 2, top edge **40r** of a rib 26 or top edge **40b** of offsetting portion **24a** of a boss **24**. In one embodiment, a riser section is rotated 15° with respect to a riser section above or below it in a stack. As best seen in FIGS. 1 and 4, bosses **24** are spaced at 60° intervals about the interior surface of sidewall **12**. Two ribs **26** are equally spaced between each pair of successive bosses. Thus, there is a boss **24** or a rib **26** located every 20° about the interior surface of the sidewall **16**. Slots **16** and corresponding projections **42** are spaced midway between adjacent bosses **24** and ribs **26** . Such slots and projections are, therefore, disposed every 20° about the horizontal ledge **28** but displaced 10° from the bosses **24** and ribs **26.**

Referring to FIGS. 1, 2, 2B and 4, channel end **27** of an upper riser section **10** receives the tapered end **37** of another riser section **10** disposed below it with bosses **24** and ribs **26** disposed in slots **16.** Bosses **24** of lower riser section **10** are aligned with, and support, projections **42b** of the upper riser section 10. Ribs **26** are aligned with, and support, the upper riser projections **42** . The two sections are secured together with screws that extend through openings 52 and hollow bores in projections **42b** into hollow bores in bosses **24.**

Additional riser sections **10** can be stacked above or below the first and second riser sections, as desired. In each case, the upper riser section is rotated 30° relative to the lower riser section to permit positioning of the offsetting portions **24a** of the bosses **24** and ribs **26** of the lower riser section within slots **16** of the upper riser section.

The relatively narrow width of slots **16** in middle wall **20**, as shown in FIGS. 3, 3A and 4, substantially limits any rotation of riser section **10** with respect to another riser section **10** stacked above or below the first riser section because the offsetting portions **24a** of bosses **24** and the ribs **26** pass through and are restricted against angular lateral movement by the sides of slots **16**.

As best seen in FIG. 2B, the height of projections **42** and **42b** is such that the edges **42a** of projections **42** or **42b** abut against edges **40b** and **40r** of bosses **24** and ribs **26**, respectively, of the second riser. Accordingly, sidewalls **12** are reinforced along the full height of sidewall **12** by the combined height of projections **42** and **42b** and either bosses **24** or ribs **26**. Outer wall **18** and middle wall **22** prevent horizontal movement of two stacked riser sections **10** with respect to each other.

Referring to FIGS. 1, 1A, 2 and 3, detachable anchor tab **14** runs along the outside surface of the sidewall **12**. The bottom-most riser section **10** within a vertical stack may be anchored in concrete (e.g., a concrete distribution box not shown), in which case anchor tab **14** serves to anchor the bottom-most riser section **10** within the concrete. In the preferred embodiment, pull handle **15** is attached near ends **13a**, **13b** of anchor tab**14**. Anchor tab **14** is severed or has a weakened cross-section at ends **13a**, **13b** such that pulling on handle **15** in a radial direction separates ends **13a** and **13b**. Preferably, anchor tab **14** is attached to the outside of sidewall **12** by a weakened region **14a**, such that continuing to pull

handle **15** away from the sidewall **12** causes anchor tab **14** to tear away form the outside surface of riser section **10** in region **14a**.

Anchor tab **14** is preferably completely removed from riser section **10** when riser section **10** is not intended to be anchored in concrete. Detaching anchor tab **14** from each of the riser sections placed above the bottom-most riser section (i.e., all of the riser sections except the bottom one that is anchored in concrete) enhances the stability of the entire stack by providing a substantially smooth external surface that is less susceptible to forces caused by ground heaving and shifting than if the external surface contained the anchor tabs **14** (or any other projecting elements, such as support ribs). In this way, the alignment and integrity of the overall riser stack is maintained in areas subject to soil movement caused by freezing and thawing or heavy traffic over the top of the riser.

A riser cover **50** (see FIG. 2A) can cover the uppermost riser section **10** in a stack of riser sections **10**. Preferably, the cover is made from the same material as the associated riser sections, namely, molded high density plastic, such as polyethylene.

The cover **50** may include a similar configuration as the channel end of riser sections **10** and may include projections **42c** having hollow bores for accepting screws or other fasteners as described above for fastening two riser sections **10** together. In an alternate configuration, the cover **50** will have an end with the same configuration as tapered end **37** of riser sections **10** and the top of the associated riser section will define a channel end such as end 27.

Referring now to FIGS. 5 - 7, there is shown a riser cover **50** of the present invention for removably closing the access to an underground component through a riser formed by stacked riser sections **10**. Riser cover **50** is shown as circular in the preferred

embodiment but can be of another shape that corresponds to the shape of the riser section to be covered.

Riser cover **50** includes a wall **53** defining a top convex surface **54**, a bottom concave surface **90**. A channel end **27c** similar to channel end **27** of riser section **10** depends from wall **53**. It includes an outer wall **18c** that defines the smooth outer peripheral surface of the cover. Channel end **27c** includes a middle wall **20c** spaced inward of outer wall **18c** that includes spaced slots **16c** shaped and spaced as the slots **16** in middle wall **20** of a riser section **10**. It defines with outer wall **18c**, outer channel **19c**. Channel end **27c** includes inner wall **22c** similar to middle wall **22** of channel end **27** of a riser section **10**. It defines with middle wall **20c**, inner channel **23c**.

Projections **42c**, best seen in FIG. 6, are located within inner channel **23c** on riser cover **50** and contain a hollow bore defining openings **52c** at top surface **54**. These bores receive a screw (not shown) to secure the riser cover on a riser section **10** by connection to the hollow bores in ends **42b** of bosses **42** of a riser section **10.**

Top surface **54** of the riser cover **50** includes two hollow wells **56**. Wells **56** are tapered, starting from a largest diameter **58** at top surface **54** to a somewhat smaller diameter, where there is a ledge **60**, then tapered again, starting from a third diameter **62** to a fourth diameter second depth.

In the preferred embodiment, wells **56** are located approximately 180° apart at a radius approximately half the radius of the entire riser cover **50**, but can be located anywhere on the riser cover and there can be more or fewer than two. Each well **56** is constructed such that a metal rod **57** can be placed inside the well prior to the riser cover **50** being buried in place while in use. The metal rod **57** shown in FIG. 5 can be, for example, a

length of number four rebar. It serves to provide a mass of metal that can be detected by a metal detector so that the cover and riser stack can be located after it is buried under soil and vegetation.

Two recessed openings **64,** for receiving a pivotably mounted, stowable handle **70,** shown in FIG. 8, are arranged such that when handles **70** are pivoted down into recess openings **64**, each handle **70** is flush with or recessed from top surface **54** of riser cover **50**. Located inside each recess opening **64** is a space **66** adapted to receive a pivot rod, about which handle **70** pivots. A screw receptacle **68** is located inside space **66**, which is used to secure the pivot rod **72** to the riser cover **50**.

Also on bottom surface **90** are two protrusions **105** corresponding to recessed openings **64,** and two cylindrical protrusions **106** corresponding to screw receptacles **68.**

Handle **70** includes a grip portion **76** adapted to be easily grasped by a hand, and a pivot portion **78** consisting of two hollow cylindrical portions **80.** Pivot rod **72** is inserted into hollow openings **82** of each cylindrical portion **80,** spanning cylindrical portion **80**, and a screw **74** is placed in screw opening **84** on pivot rod **72** and secured to screw receptacle **68** located inside space **66** of cover **50**.

FIG. 6 shows bottom surface **90** of riser cover **50**. One difference in cover channel end **27c** from channel end **27** of riser section **10** is the protrusions **93** contained at various positions on the middle wall **20c** of the riser cover **50** disposed between adjacent slots **16c**. Protrusions **93** are used to "child proof" the cover. A screw or other suitable fastener is inserted through webs **34** in outer wall **18** of the top riser section **10** in a riser stack. The fastener pierces aligned protrusion **93** to provide a further connection between

cover **50** and the associated top riser section **10**. The fastener must be removed to remove the cover from the top riser section.

Referring to FIG. 6, a cylindrical wall **94** is located on bottom surface **90**, concentric with channel end **27c** of riser cover **50**. A plurality of vertically disposed support ribs **96**, each extending radially out from the cylindrical wall **94** to the inner wall **22c** of the cover channel end **27c**, are provided on bottom surface **90**. Bottom edges **94a** and **96a** of cylindrical wall **94** and support ribs **96** define surfaces for contact with top surface **54** of another cover, when such covers are stacked upon each other. In other embodiments, where the riser cover is of a different shape, the central wall may be cylindrical or may have the same general shape as the walls of the channel end and be set in from the interior wall, with reinforcing ribs extending from the central wall to the interior wall of cover channel end, which is concentric with or (in the case of a square- or rectangular-shaped cross-section) parallel to the outer sidewall outer surface.

Also on bottom surface **90** of riser cover **50** are two hollow posts **98**. These posts define the wells **56** located on top surface **54** of cover **50**. Posts **98** are vertically elongate and extend below channel end **27c**.

Each post **98** has a first diameter **100** at its base, then tapers to a second diameter **101** at a midpoint where there is a shoulder **102**. There, the post transitions to a third diameter **103**, and then tapers to a fourth diameter **104** at the end thereof, similar to the shape of wells **56**. Each post **98** and well **56** is sized such that the post **98** of a first riser cover **50** will fit inside the well **56** of a second riser cover **50**. Thus, the portion of the post **98** between the third and fourth diameters fits within the portion of a well **56** on an associated cover between third diameter **62** and the fourth diameter at the bottom of the well. The

portion of the post **98** from its base **100** to second diameter **101** fits within the tapered portion of well **56** between its largest diameter **58** and the smaller diameter at ledge **60**. This arrangement allows for easy stacking of a plurality of riser covers both for storage and for shipping.

An actual cover **50** has been constructed which embodies the principles of the present invention. It is approximately twenty-two and one-half inches in diameter at the outer peripheral surface of outer wall **18c**. Each post **98** is about three inches in length from base **100** at bottom surface **90** of cover **50** to end **104**, which is about 3/4 inch in diameter. The wells **56** of posts **98** are about 7/8 inch in diameter at top surface **54** of cover **50**.

Vertical centerlines passing through each well are 9 1/2 inches apart. The horizontal centerlines of pivot rods **72** are 15 1/2 inches apart. The recesses **64** are aligned with the wells **56** of posts **98**. Six openings **53** are positioned 60° apart on top surface **54**. The slots **16c**, and consequently the projections **42c**, are 20° apart.

A mounting bracket **110** (shown in FIGS. 9 - 11) is provided to secure a riser section in position on a wall of concrete form while the riser section is being molded in concrete. The mounting bracket **110** is generally inverse U-shaped, having a flat top portion **113** and sidewall **116** that diverge from the top portion **113**. Flanges **114** project from sidewalls **116**. Flanges **114** have holes **118** for securing mounting bracket **110** to the floor of a concrete form. Top portion **113** has at least two apertures **120**, which have tapered sides **122** that form gripping webs.

It may also include a hole **123** centrally located in top **113** that may be used for sighting to position the bracket over a mark, for example, placed on the wall of the form. As each post or post **98** is inserted into an aligned aperture **120**, tapered sides **122** engage the

post at a point between third diameter **103** and fourth diameter **104** of post **98,** creating a tight, friction fit between post **98** and tapered sides 122 of aperture **120**, as shown in FIG. 11.

As illustrated in FIG. 11, mounting bracket **110** is secured on form wall or floor **132** of form **130** by screws or other fasteners inserted in bore holes **118**. A riser section **10** with anchor tab **14** attached is then placed into form **130**, around mounting bracket **110**, with channel end **27** of riser section 10 substantially in contact with floor **132** of form **130**. Riser cover **50** is then placed on riser section **10** and positioned with channel end **27c** in place on tapered end **37** of the riser section **10**. The cover **50** may be secured to the riser section by screws in openings **52c.** The cover is secured in position as posts **98** are inserted into corresponding apertures **120** of mounting bracket **110** and frictionally grasped by tapered sides **122**.

Alternatively, riser cover **50** can be placed and secured on riser section **10** before riser section **10** is placed into form **130**. Then, the riser section **10** and riser cover **50** assembly are placed into form **130**. Posts **98** are inserted into apertures **120** on mounting bracket **110.**

After the riser section **10** is positioned and secured on form wall **132,** concrete is poured into the form **130**, preferably to a level above the detachable anchor tab **14** and below riser cover **50**. Once the concrete is cured, riser cover **50** is removed from riser section **10** and mounting bracket **110** by pulling the posts from their frictional engagement with apertures **120.**

Riser section **10,** thus anchored in concrete, may then be used as the bottom-most riser section in a stack of riser sections **10** to define an access to an underground component such as a concrete distribution box. Cover **50** is secured to the top riser section to

close and seal the access. The cover **50** is removed when access to the underground component is required.

Whereas the present invention is described herein with respect to specific embodiments thereof, it will be understood that various changes and modifications may be made by one skilled in the art without departing from the scope of the invention, and it is intended that the invention encompass such changes and modifications as fall within the scope of the appended claims.